ENCLOSURE

Arroyo Grande Aquifer Exemption Application

Issue/Comment	Additional Information Requested
HYDRAULIC ISOLATION	
1. The demonstration of hydraulic isolation (by the fault, facies change, and tar seals) requires additional technical information, as described below: a. *The Arroyo Grande fault to the north.* The application does not provide any information on the transmissivity, rock properties, or other relevant characteristics of the fault. If the fault is not, in and of itself, a barrier to fluid migration (which cannot be determined from the information provided), it is possible that flow could occur across the northern boundary of the aquifer proposed for exemption, as cross sections A-A', D-D', and F-F' show the presence of the Edna/Dollie (in yellow) on either side of the fault. b. *Facies change from the Edna/Dollie to the low-permeability Miguelito to the south.* The facies change appears to be supported by cross sections A-A', C-C', and E-E'. However, none of the provided cross sections covers the southwestern area near the original aquifer exemption boundary, where the Pismo formation begins to extend past the edge of the proposed expanded exemption boundary. c. *Lateral tar seal and/or loss of permeability to the west and east.* Cross-section B-B' shows the Edna/Dollie extending across the western boundary of the zone to be exempted with no facies change or other apparent barrier to fluid migration. The application does not provide porosity, permeability, or other data (e.g., data about the continuity of low permeability zones) supporting the delineation of this boundary to the west. According to the cross section, the tar seal (for which no permeability or other information is provided) occurs approximately 500 ft below ground surface at the western boundary of the proposed exemption, while the Edna/Dollie extends to about 1,250 ft below ground surface. A similar scenario is shown at the eastern boundary.	a. Please provide any information on the transmissivity, rock properties, or other relevant characteristics of the fault to better demonstrate its geological properties and to clarify the extent to which the fault is a barrier to fluid migration. If the fault is not, in and of itself, a barrier to fluid migration, please provide details (including a map) of any drinking water wells to the north of the proposed exempted aquifer, along with an analysis of the capture zone for each of the identified wells. This information is critical for determining whether the aquifer proposed for exemption is a current source of drinking water, i.e., whether any existing drinking water well will capture water from the proposed exempted area during the life of the well. b. Please provide as much information as possible to demonstrate that the facies change acts as a barrier to fluid movement and to delineate/justify the proposed southwestern exemption boundary. c. Please provide as much information as possible to demonstrate the characteristics of the tar seals to act as barriers to fluid movement and to delineate/justify the proposed western and eastern exemption boundaries.

The application does not provide permeability data or other information to demonstrate that there is a geologic barrier to fluid flow in these areas.	
2. Permeability of the injection zone is given as 300 mD to 2 D in Section 2.1.3 of the application. This appears to be consistent with the core analysis values provided in Appendix B 3 (assuming that max K is given in mD). Appendix B 3 also includes porosity data. However, while the information provided is sufficient to provide a general characterization of the injection zone, there is insufficient information to demonstrate hydraulic isolation based on facies changes or other changes in permeability. For example, cross-section B-B' shows the Edna/Dollie extending across the western boundary of the zone to be exempted with no apparent facies change or other geologic barrier to fluid migration. The application does not appear to provide porosity, permeability, or other data supporting the delineation of this boundary (refer to item #1 above).	Please provide any additional data, analyses, or technical justification to demonstrate hydraulic isolation of the Dollie Sands from the surrounding aquifers. See also Item #1 above.
3. The rationale for the proposed AE boundaries is explained in Section 2 of the application, which takes into account ongoing and planned injection operations. Additional technical information is needed to justify the actual boundaries of the expanded area and to demonstrate that injected fluids will not flow beyond these boundaries, as explained further below (refer to item #1 above).	Please clarify the technical basis for the proposed boundaries, and provide any additional technical justification to demonstrate that injected fluids will not flow beyond the proposed boundaries. See also item #1 above.
4. Regarding the vertical confinement of the proposed aquifer, there is presumed to be no upper confining zone because the proposed exempted area extends to the surface. Per Section 2 of the application and the cross-sections in Appendix A, the lower confining zone is the low-permeability (1.7 mD) Miguelito Member of the Pismo Formation. However, state documentation cited in the application provides evidence of inconsistent distribution of and discontinuities in the Miguelito, which is not addressed by the application.	Please provide any additional data, analyses, or technical justification to address the lower hydraulic isolation of the Dollie Sands from surrounding aquifers in light of the inconsistent distribution of and discontinuities in the lower confining zone (Miguelito Member of the Pismo Formation).
5. Information regarding the hydraulic regime is not sufficient, as follows: a. The application contains a basic hydraulic analysis assessing fluid containment, which evaluates the likelihood of fluid passing a certain elevation (a "spill point") based on subsurface pressures. The assessment appears to assume a hydraulically isolated injection zone (i.e., no-flow boundary conditions), which	a. Please provide technical justification for selecting the spill point elevation, an explanation of whether it can be uniformly applied at all boundaries, and any available pressure data.

may not be appropriate for the site (refer to item #8 above). The application does not include a technical justification for selecting the elevation of 275 ft as the spill point in the hydraulic analysis. Also, there is no explanation of how or whether this elevation can be uniformly applied at all boundaries of the exempted area, nor any pressure data for that elevation. b. The analysis does not appear to consider any effects of existing or future saturation in the aquifer (the pressure response in the reservoir is a direct function of saturation levels, especially in closed domains as is assumed by this analysis) or of buoyancy-driven fluid movement. c. The analysis is supplemented by qualitative descriptions of certain operational factors (injection/production volumes and dewatering) that would contribute to hydraulic containment, but no supporting data are provided for these factors.	b. Please explain how the analysis includes the consideration of the effects of existing or future saturation in the aquifer. c. Please provide any supporting data on the operational factors, especially any that could contribute to hydraulic containment of fluids within the proposed exempted area.
CURRENT SOURCE ANALYSIS	
6. Appendix G 1-1 describes activities undertaken to inventory water supply wells within 1 mile of the oil field, including a review of well completion reports and a walking survey. The Statement of Basis indicates that the operator worked with the state and regional water boards during this process. The aquifer exemption package states that no drinking water wells were identified within the proposed area to be exempted. However, to determine whether the aquifer proposed for exemption is a current source of drinking water, it is not sufficient to demonstrate that there are no drinking water wells within the areal boundaries of the proposed exempted aquifer. It is also necessary to identify and evaluate all public and private drinking water wells that are outside the areal boundary of the proposed exempt area, but which may draw water from the aquifer during the lifetime of the existing drinking water well. The well survey information provided with the AE request identified numerous water supply wells within a 1-mile radius of the Arroyo Grande oil field. These included 24 wells screened in the Edna Member within a 1-mile radius of the oilfield (also, there were an additional 53 wells for which depth/formation information was not available). It is unclear whether these wells are used for drinking water or another purpose (refer to item	Please identify and evaluate all current public and private drinking water wells that are outside the areal boundary of the proposed exempt area but which may draw water from the aquifer. Provide an analysis to determine whether any of the wells may draw water from the aquifer proposed for exemption during the lifetime of these existing drinking water wells.

#6 below).	
7. Appendix G 1-1 provides a table of wells within 1 mile of the oilfield, giving some information on depths and aquifers, but not owner or age of well. The accompanying text states that individual well records and locations were aggregated for confidentiality. Information is only provided for approximately 50% of the wells identified, as completion reports were not available for the other 50%. The Appendix does not include information on well purpose, so it is not clear if the wells listed are in fact drinking water wells, or if the water is used for irrigation, livestock, or other purposes.	Please provide the purpose of each of the wells in Table A-1 of Appendix G 1-1, specifically clarifying if the well is a drinking water supply well, and provide any available information on the age of the wells.
8. Several public comments (e.g., 0007-27, 0011-4, and 0073-2) suggest that the well inventory is incomplete and identify wells that may have been missed during the well survey. Also, in its response to public comment 0005-17/0005-26/0005-27, DOGGR (global comment) indicated that certain wells, screened in both the Miguelito and the Edna, likely draw solely from the Edna. Based on the available information, this appears to be a reasonable statement. However, the response goes on to say, "The Edna is not hydraulically connected to the oil bearing Dollie sandstone inside the proposed aquifer exemption area." This statement appears to contradict other statements in the aquifer exemption package, which consider the Edna and the Dollie to be the same formation (for example, refer to Section 4.1, page 14 of the application).	Please provide any available information on the wells mentioned in the public comments. If these wells are not pertinent to the AE request/analysis, please explain this in your response. In addition, please address the discussion of the Edna and Dollie Formations to clarify whether they are hydraulically connected and whether they are indeed the same formation.
9. Regional groundwater patterns are characterized in Section 4 and Appendix G 1-1 of the application. However, the application does not provide site-specific directional groundwater flow information, stating instead that the zone proposed for exemption is hydraulically isolated from the surrounding area. Also, information on the nearby drinking water wells (e.g., expected life, use/production rates, capture zones, screened depths, etc.) is not provided.	As part of the analysis needed to fully evaluate the aquifer proposed for exemption, please provide site-specific groundwater flow information (direction and speed). As noted above, providing details about nearby drinking water wells, including analyses of the capture zone for each of the identified wells, is critical for determining whether the aquifer proposed for exemption is a current source of drinking water. Please provide this information/analysis.
10. Appendix G 1-1 states that the water well inventory includes wells within a 1-mile radius of the Arroyo Grande oil field. No specific rationale is provided for choosing this 1-mile radius for consideration of potential effects on water supply wells. Also, because the oilfield boundary is not the same as the proposed AE boundary, there are locations where the edge of the search area	Please provide the rationale for determining the size of the area selected for the evaluation of nearby water supply wells, justifying that the selected area is sufficient to identify all wells that may draw water from the aquifer proposed for

is less than 1 mile from the proposed AE boundary. This is shown in Figure 1 of the Statement of Basis ("Locations of Water Supply Wells within the Vicinity of the Proposed Aquifer Exemption Boundary"), particularly on the eastern and southern edges of the proposed AE.	exemption during their lifetimes.
OTHER	
11. Although maps are provided in Figure 1-1, Figure 2-1, and Appendix A 4-1 of the application, all locational information is provided in T/S/R format. There are no specific three-dimensional coordinates provided to clearly define the boundaries of the proposed exempted area. Three dimensional coordinates (e.g., provided in GIS files) will clearly delineate the proposed boundary and support the need to make AE information available to the public.	Please provide the three-dimensional coordinates that delineate the proposed exempted area.